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DATE: December 14, 2007

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SUBJECT: IRONBOUND ATHLETIC FIELD ARTIFICIAL TURF INVESTIGATION
WORK ASSIGNMENT #EAC00292 - FINAL REPORT

BACKGROUND

This report details a multimedia investigation conducted on November 1, 2007 by Lockheed Martin Response Engineering and Analytical Contract (REAC) personnel at the request of Environmental Protection Agency (EPA) Region II through the EPA Environmental Response Team (ERT), to determine source(s) of lead contamination at the Ironbound Athletic Field. This field is located on St. Charles Street in Newark, Essex County, New Jersey (NJ), in a mixed residential and commercial neighborhood. It is covered in artificial turf, reported to be nearly ten years old, and is configured for soccer and baseball. The only exposed soil is in the baseball infield and along the perimeter.

Adjacent to the athletic field is the former location of the Tidewater Baling Corporation. The company began operations in 1945 and processed and recycled various types of scrap metal. Operations at the facility ceased several years ago. The EPA is evaluating the property for a Removal Action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The soil is contaminated with heavy metals, polychlorinated biphenyls (PCBs) and petroleum hydrocarbons. Lead concentrations as high as 32,000 milligrams per kilogram (mg/kg) have been detected in surface soils.

Due to concerns for potential migration of contaminants from the Tidewater site to the adjoining ball field, the New Jersey Department of Health and Senior Services (NJDHSS) collected vacuum, wipe, turf and soil samples from the Ironbound Athletic Field on August 16, 2007. Elevated levels of lead were detected in the dirt embedded in the turf. Further analysis of the samples and the turf fibers indicated that the turf itself was contributing to the lead contamination. The highest concentration reported in a turf sample was 3500 mg/kg. The mean lead concentration in surface dust was 3742 mg/kg. Based on these results, the NJDHSS recommended to the City of Newark on October 29, 2007, that access to the athletic field be restricted until further notice (Pulliam 2007).

REAC conducted a further investigation on November 1, 2007, involving the collection of samples of soil, turf, mat (beneath the turf), residue and dust, to determine the source(s) of lead contamination at the site. Soil samples were collected from the baseball infield and from the perimeter of the field and analyzed for lead and PCBs to confirm the results of previous investigations. Multimedia samples were collected from areas covered by artificial turf, including soil/dust material present on the turf surface (collected by vacuum), the turf, the two mat layers underlying the turf, and residue between the top mat and the turf. All materials were analyzed for lead; one dust and one composited residue

sample were also analyzed for PCBs. All work was carried out by REAC personnel under the technical direction of the EPA/ERT.

OBSERVATIONS AND ACTIVITIES

X-Ray Fluorescence Measurements

A hand-held field portable X-Ray Fluorescence (XRF) instrument was used to screen for lead on soil and turf surfaces to identify sampling locations. Quality control (QC) and detection limit samples were analyzed at the ERT/REAC laboratory prior to site deployment. A final detection limit and precision QC sample were run on-site at the conclusion of XRF sample measurements. Lead measurements were taken using a 60 second exposure time and a Niton *in-situ* adaptor. The XRF measurements were performed in accordance with REAC Standard Operating Procedure (SOP) #1720: *Operation of the Niton XLt792YW Field Portable X-Ray Fluorescence Instrument*. Site soil was screened at 18 locations around the perimeter of the site and in the baseball infield. Artificial turf screening was performed at 21 locations (Figure 1). Examination of the spectra indicated the presence of lead (see Table 1).

Soil Sampling Procedures

A total of 18 surface soil samples (0 to 2 inches in depth) and a duplicate were collected from the five infield areas, both dugouts, and from along the perimeter as shown on Figure 1. Soil samples were collected with disposable scoops and placed directly into glass jars for transport to the laboratory, in accordance with REAC SOP #2012, *Soil Sampling*. Green fibers from the artificial turf were noticeable throughout site soil. When possible, these fibers were excluded from the soil sample. Soil samples were analyzed for lead and PCBs.

Dust Sampling Procedures

Samples were collected at five locations covered by artificial turf (Figure 1). Dust samples were collected first, using a Nilfisk GS-80 vacuum cleaner in accordance with REAC SOP 2040: *Collection of Indoor Dust Samples from Carpeted Surfaces for Chemical Analysis Using a Nilfisk GS-80 Vacuum Cleaner*. The areas selected for sampling were centered on the selected XRF measurement locations. The size of the sampled area was based on professional judgment. Because the artificial turf was fairly clean, relatively large areas were sampled (169 square feet [sf] at four locations, 84.5 sf at the fifth location) to ensure collection of sufficient sample material. One sampled area was square; the other areas, located near the edge of the turf, were rectangular in order to keep the area centered on the XRF measurement location while minimizing the vacuuming of adjacent soil. The collected samples were placed into appropriately-sized glass jars.

Artificial Turf And Residue Sampling Procedures

After dust collection, artificial turf samples were taken at the same locations. The turf – the actual playing surface of the field – has small green fibers designed to mimic grass. Beneath the turf is a rubbery mat (“mat 1”) which is black and relatively homogeneous. Below that is another mat layer (“mat 2”), also black but with gravel-like material impregnated into the rubbery material. The three layers (turf, mat 1 and mat 2) were successively cut in approximately 2-inch x 4-inch pieces using a non-dedicated stainless steel utility knife. The knife was cleaned between samples using deionized water and isopropyl alcohol. Below mat 2 was a thick layer of angular gravel that prevented sampling of soil from beneath the turf. Turf and mat samples were analyzed for lead.

At two of the selected locations, fine-grained material (“residue”) was located between the turf and mat 1 in quantities sufficient for sampling. These residue samples were analyzed for lead. A composite of the residue samples was analyzed for PCBs.

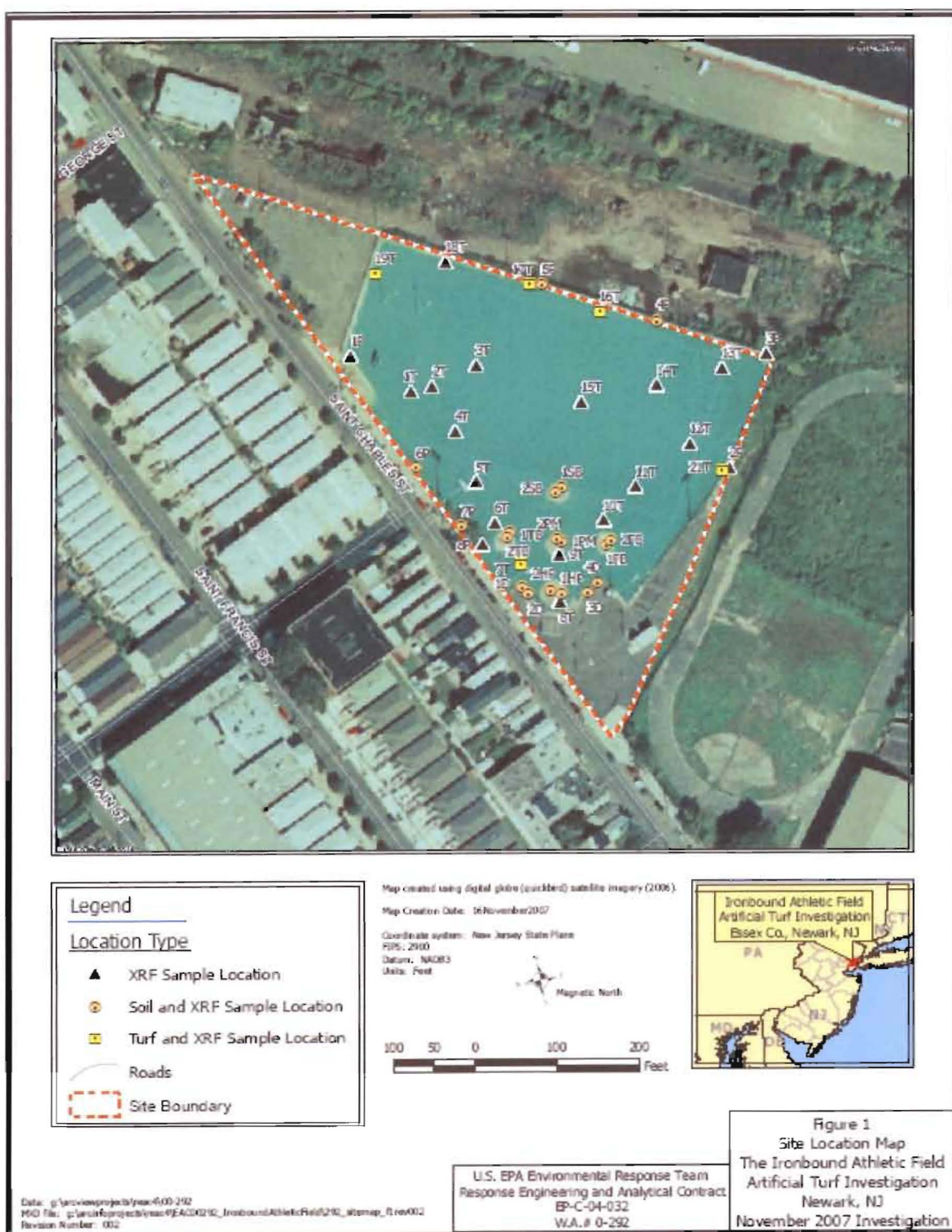


TABLE I
XRF MEASUREMENTS
IRONBOUND ATHLETIC FIELD ARTIFICIAL TURF INVESTIGATION
NEWARK, NEW JERSEY

Location	XRF Lead, mg/kg
1T	3062±71
2T	2930±67
3T	2786±70
4T	2897±74
5T	3261±73
6T	3247±77
7T	3468±79
8T	519±40
9T	759±49
10T	3268±79
11T	1909±55
12T	2897±68
13T	2998±69
14T	2946±69
15T	2851±68
16T	3162±74
17T	3229±78
18T	3307±78
19T	3446±85
20T	2842±80
21T	3316±76
1P	U
2P	62±17
3P	25±13
4P	73±20
5P	U
6P	65±17
7P	46±17
8P	53±18
1D	33±13
2D	42±14
3D	39±14
4D	41±14
1HP	22±12
2HP	26±13
1PM	28±14
2PM	24±13
1FB	40±14
2FB	23±12
1SB	26±12
2SB	21±9
1TB	32±13
2TB	22±13

U: below detection limit

ANALYTICAL METHODOLOGY

Handling of samples was performed in accordance with REAC SOP #4005, *Chain of Custody Procedures*. All dust samples delivered to the REAC facility were sieved in accordance with modified REAC SOP #2040, *Collection of Indoor Dust Samples From Carpeted Surfaces for Chemical Analysis Using a Nilfisk GS-80 Vacuum Cleaner*, using a No. 100 sieve (150 microns [μm]). The total and sieved weights for each sample were measured and recorded. Sample weights were used to calculate the dust loading (mass of dust per unit surface area) on the artificial turf.

The turf samples were washed with deionized water four times and allowed to air dry prior to analysis. Lead analysis was conducted on “whole turf” samples (fibers and backing) and also on the fibers alone, to isolate the source of the lead. The mat samples were cut into small pieces prior to digestion and analysis.

Soil, dust, turf and residue samples were analyzed for lead according to REAC SOP #1811: *Determination of Metals by Inductively Coupled Plasma (ICP) Methods*. PCB analysis of soil, dust and residue was by REAC SOP #1801, *Routine Analysis of PCBs in Water and Soil/Sediment Samples by GC/ECD*.

ANALYTICAL RESULTS

Soil Samples

Analytical results for soil samples are presented in Table 2 and in the analytical report in Appendix A. Associated XRF measurements are also reported in Tables 1 and 2. The estimated detection limit for XRF is 50 to 60 mg/kg. The lead concentrations in soil samples ranged from 4.1 mg/kg (duplicate sample 2TBD) to 29.7 mg/kg (sample 7P).

PCBs, as Aroclor 1260, were detected in only two samples (6P and 7P, located along the St. Charles Street perimeter) at estimated concentrations below the reporting limit.

Dust Samples

Dust sample analytical results and dust loadings are presented in Table 3. The highest concentration of lead in the sieved portion of the samples, which excludes particles above 150 μm in size, was 2290 mg/kg, in sample 16T. This sample also had the lowest dust loading and the greenest color of all the sieved samples (see photos in Appendix B). The lowest lead concentration (230 mg/kg) was found in sample 21T, which also had the highest dust loading and the least amount of green coloration. Thus, dust loading appears to be negatively correlated with lead concentration, while intensity of green coloration is positively correlated.

Dust samples (21T) contained 0.046 mg/kg PCBs.

Artificial Turf and Residue Samples

Analytical results for the turf materials and residue, and associated surface XRF measurements, are presented in Table 4. Lead concentrations in mat 1 ranged from 3.55 (sample 7T) to 16.3 mg/kg (sample 16T). In mat 2, lead concentrations ranged from below the reporting limit to 25.1 mg/kg (sample 7T). Lead concentrations were higher in fibers (4330-4950 mg/kg) than in the samples of whole turf (fiber plus backing) (3730-4020 mg/kg) from the same location; this suggests that the fibers are a greater source of the lead contamination than the backing material.

TABLE 2
SOIL ANALYTICAL RESULTS AND XRF MEASUREMENTS
IRONBOUND ATHLETIC FIELD ARTIFICIAL TURF INVESTIGATION
NEWARK, NEW JERSEY

Location	Sample ID	XRF Lead, ^a mg/kg	Lead, ^b mg/kg	PCB, mg/kg
1P	--	U	NS	NS
2P	--	62±17	NS	NS
3P	--	25 [†] ±13	NS	NS
4P	42687	73±20	9.80 J-	U
5P	42688	U	7.34 J-	U
6P	42665	65±17	22.3 J-	0.0406 J
7P	42666	46 [†] ±17	29.7 J-	0.0266 J
8P	--	53 [†] ±18	NS	NS
1D	42667	33 [†] ±13	14.0 J-	U
2D	42668	42 [†] ±14	12.0 J-	U
3D	42685	39 [†] ±14	8.87 J-	U
4D	42686	41 [†] ±14	15.3 J-	U
1PM	42672	28 [†] ±14	5.24	U
2PM	42673	24 [†] ±13	5.38	U
1HP	42674	22 [†] ±12	6.58	U
2HP	42675	26 [†] ±13	6.68	U
1FB	42676	40 [†] ±14	13.0	U
2FB	42677	23 [†] ±12	6.13	U
1SB	42678	26 [†] ±12	6.06	U
2SB	42679	21 [†] ±9	10.5	U
1TB	42671	32 [†] ±13	8.22	U
2TB	42669	22 [†] ±13	4.18	U
2TBD	42670	--	4.10	U

^aField measurement

^bLaboratory results

[†]Below XRF detection limit of 50-60 mg/kg

U: Not detected

J: Estimated value below reporting limits

J-: Estimated low

NS: Not sampled

TABLE 3
DUST ANALYTICAL AND LOADING RESULTS
IRONBOUND ATHLETIC FIELD ARTIFICIAL TURF INVESTIGATION
NEWARK, NEW JERSEY

Location	Sample ID	Area Sampled, m ²	Area Sampled, ft ²	Total Weight, g	Dust Loading, g/ft ²	Sieved Weight, g	Lead, mg/kg	Total mg Lead per Sieved Sample	Lead ¹ , mg/ft ²
7T	42661	15.7	169	362.12	2.14	24.62	1340	33.0	0.195
16T	42659	15.7	169	51.70	0.31	12.86	2290	29.4	0.174
17T	42657	7.84	84.4	324.91	3.85	4.02	1410	5.67	0.0672
19T	42658	15.7	169	318.73	1.89	4.25	1130	4.80	0.0284
21T	42660	15.7	169	1125.80	6.66	145.42	230	33.4	0.198
								Average:	0.133

m²: square meter
ft²: square feet
g: grams
g/ft²: grams per square foot

mg/kg: milligrams per kilogram
mg/ft²: milligrams per square foot
¹Concentration in particles smaller than 150 µm

TABLE 4
TURF MATERIALS ANALYTICAL RESULTS AND XRF MEASUREMENTS
IRONBOUND ATHLETIC FIELD ARTIFICIAL TURF INVESTIGATION
NEWARK, NEW JERSEY

Location	Sample ID	Material	Lead, mg/kg
7T	--	Surface via XRF ^a	3468±79
	42698	Turf - Whole	3730
	42698	Turf - Fibers	4920
	42699	Mat 1	3.55
	42700	Mat 2	25.1
16T	--	Surface via XRF ^a	3162±74
	42692	Turf - Whole	4020
	42692	Turf - Fibers	4950
	42693	Mat 1	16.3
	42693	Mat 1 DUP	14.8
	42694	Mat 2	5.09
17T	--	Surface via XRF ^a	3229±78
	42689	Turf - Whole	3990
	42689	Turf - Whole DUP	3860
	42689	Turf - Fibers	4580
	42689	Turf - Fibers DUP	4330
	42684	Residue	196 J+
	42690	Mat 1	7.06
	42691	Mat 2	U
19T	--	Surface via XRF ^a	3446±85
	42683	Turf - Whole	3940
	42683	Turf - Fibers	4850
	42680	Residue	270 J+
	42682	Mat 1	5.97
	42681	Mat 2	4.51

TABLE 4 (Continued)

Location	Sample ID	Material	Lead mg/kg
21T	--	Surface via XRF ^a	3316±76
	42695	Turf - Whole	3960
	42695	Turf - Fibers	4900
	42696	Mat 1	14.2
	42697	Mat 2	4.76

^aField measurement

J+: Estimated high

U: Not detected

Lead concentrations in the two residue samples were 196 mg/kg and 270 mg/kg. Compositied residue contained PCBs at 0.085 mg/kg.

CONCLUSIONS

The artificial turf (whole turf and turf fibers) collected from the Ironbound Athletic Field contained lead in higher concentrations than found in the soil, dust, top mat, bottom mat and residue samples. Turf fibers are subjected to abrasion from physical impact during normal use of the field, which explains the presence of loose turf fibers in surface soil. The analytical results show that the turf, and in particular, the turf fiber, is the major source of lead at this site. Lead levels in fibers were higher than in the samples containing fibers plus backing. The amount of dust present on a given area of turf surface appears to be negatively correlated with lead concentration in the dust, which may be explained by the dilution of turf-derived lead by increased quantities of dust or soil. The positive relationship between the intensity of green coloration of dust and the lead concentration is also noted.

FUTURE ACTIVITIES

Future activities will be determined by ERT.

cc: Central File WA EAC00292 (w/attachments)
Electronic File: L:/Archive/REAC4/0292/D/TR/0292-DTR-120507
Dennis Miller, REAC Program Manager (cover page only)

APPENDIX A
Final Analytical Report
Ironbound Athletic Field Artificial Turf Investigation
Newark, New Jersey
December 2007

ANALYTICAL REPORT

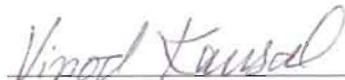
Prepared by
LOCKHEED MARTIN, Inc.

Ironbound Athletic Field Artificial Turf Investigation
Newark New Jersey

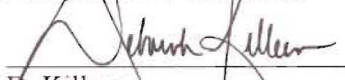
November 2007

EPA Work Assignment No. 0-292
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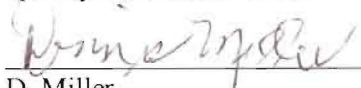
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Appendices will be furnished on request

Introduction

REAC, in response to WA#-292, provided analytical support for environmental samples collected from the Ironbound Athletic Field Artificial Turf Investigation in Newark, NJ as described in the following table. The support also included QA/QC, data review and preparation of an analytical report containing analytical and QA/QC results.

The samples were treated with procedures consistent with those specified in REAC SOP #1008.

COC #	Number of Samples	Sampling Date	Date Received	Matrix	Analysis/ Method	Laboratory	Data Package
292-11/02/07-0002	19	11/01/07	11/05/07	Soil	PCB/REAC SOP 1801	REAC	S 331
	19				Lead/REAC SOP 1811		S 319
292-11/06/07-0004	5	11/01/07	11/06/07	Dust			S 322
292-11/02/07-0003	2			Residue			S 336
	10			Mat			S 341
	5			Turf			
40591	2		11/14/07	Soil	PCB/REAC SOP 1801	REAC	S 343

¹ REAC is NELAP certified for PCB and lead analyses.

Case Narrative

The laboratory reported the data to three significant figures. Any other representation of the data is the responsibility of the user. All data validation flags have been inserted into the results tables. At the request of the WAM, samples were analyzed for lead only.

PCBs in Soil Package S 331

The data package was examined and found to be acceptable.

Lead in Soil Package S 319

Lead was below the % recovery (%R) criterion for the MS of sample 42666. Lead is qualified estimated low (J-) for samples 42665 thru 42668 and 42685 thru 42688.

Lead in Dust Package S 322

The data package was examined and found to be acceptable.

Lead in Mat and Residue Package S 336

Lead was above the % R criterion for the MS/MSD of sample 42684. Lead is qualified estimated high

(J+) for samples 42680 and 42684.

Lead in Turf Package S 341

At the request of the Work Assignment Manager, the turf samples were washed with distilled water four times to remove any dirt or debris, air dried for 24 hours and dried in an oven at 50 degrees C for 10 hours prior to sample digestion. The samples identified as "Turf" were prepared using the entire sample including the turf fibers and the backing. The samples identified as "Fiber" were prepared using only fibers from each sample.

The data package was examined and found to be acceptable.

PCB in Soil Package S 343

Sample 1923 is a composite of samples 42680 and 42684 from chain of custody record #2920110207-0003.

Samples 1923 and 42660 exceeded the 14 day holding time criterion for PCB extraction. The WAM requested analysis for PCBs from these samples despite the holding time. The results in these samples are qualified estimated (J).

Summary of Abbreviations

BFB	Bromofluorobenzene
C	Centigrade
CLP	Contract Laboratory Program
COC	Chain of Custody
conc	concentration
cont	continued
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
D	(Surrogate Table) value is from a diluted sample and was not calculated
Dioxin	denotes Polychlorinated dibenzo-p-dioxins (PCDD) and Polychlorinated dibenzofurans (PCDF)
DFTPP	Decafluorotriphenylphosphine
EMPC	Estimated maximum possible concentration
GC/MS	Gas Chromatography/ Mass Spectrometry
IS	Internal Standard
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MS (BS)	Matrix Spike (Blank Spike)
MSD (BSD)	Matrix Spike Duplicate (Blank Spike Duplicate)
MW	Molecular Weight
NA	Not Applicable or Not Available
NC	Not Calculated
NR	Not Requested
NS	Not Spiked
% D	Percent Difference
% REC	Percent Recovery
SOP	Standard Operating Procedure
ppbv	parts per billion volume
ppm	parts per million
pptv	parts per trillion volume
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QL	Quantitation Limit
REAC	Response Engineering and Analytical Contract
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SIM	Selected Ion Monitoring
Sur	Surrogate
TIC	Tentatively Identified Compound
TCLP	Toxic Characteristics Leaching Procedure
VOC	Volatile Organic Compounds
*	Value exceeds the acceptable QC limits.

m ³	cubic meter	g	gram	kg	kilogram	L	liter
μg	microgram	μL	microliter	mg	milligram	ml	milliliter
ng	nanogram	pg	picogram				

Data Validation Flags

J	Value or Reporting limit is estimated
J+	Value is estimated high (Metals only)
J-	Value is estimated low (Metals only)
R	Value is unusable
U	Not detected
UJ	Not detected and reporting limit estimated

Rev. 11/20/06

Table 1.1 Results of the Analysis for PCBs in Soil
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Dry Weight

Method REAC SOP 1801

Page 1 of 3

Sample Number	SBLK110507		42669		42665		42673		42672	
Location	-		2TB		6P		2PM		1PM	
Percent Solids	100		95		96		91		92	
	Result.	RL	Result.	RL	Result.	RL	Result.	RL	Result.	RL
Analyte	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Aroclor 1016	U	41.7	U	43.9	U	43.4	U	45.8	U	45.3
Aroclor 1221	U	83.3	U	87.7	U	86.8	U	91.6	U	90.6
Aroclor 1232	U	41.7	U	43.9	U	43.4	U	45.8	U	45.3
Aroclor 1242	U	41.7	U	43.9	U	43.4	U	45.8	U	45.3
Aroclor 1248	U	41.7	U	43.9	U	43.4	U	45.8	U	45.3
Aroclor 1254	U	41.7	U	43.9	U	43.4	U	45.8	U	45.3
Aroclor 1260	U	41.7	U	43.9	40.6	J 43.4	U	45.8	U	45.3
Aroclor 1268	U	41.7	U	43.9	U	43.4	U	45.8	U	45.3

Table 1.1 (cont) Results of the Analysis for PCBs in Soil
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Dry Weight

Method REAC SOP 1801

Sample Number	42671		42670		42674		42668		42667	
Location	1TB		2TBD		1HP		2D		1D	
Percent Solids	94		94		90		97		98	
Analyte	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg
Aroclor 1016	U	44.3	U	44.3	U	46.3	U	43.0	U	42.5
Aroclor 1221	U	88.7	U	88.7	U	92.6	U	85.9	U	85.0
Aroclor 1232	U	44.3	U	44.3	U	46.3	U	43.0	U	42.5
Aroclor 1242	U	44.3	U	44.3	U	46.3	U	43.0	U	42.5
Aroclor 1248	U	44.3	U	44.3	U	46.3	U	43.0	U	42.5
Aroclor 1254	U	44.3	U	44.3	U	46.3	U	43.0	U	42.5
Aroclor 1260	U	44.3	U	44.3	U	46.3	U	43.0	U	42.5
Aroclor 1268	U	44.3	U	44.3	U	46.3	U	43.0	U	42.5

Table 1.1 (cont) Results of the Analysis for PCBs in Soil
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Dry Weight

Method REAC SOP 1801

Page 2 of 3

Sample Number	42666		42678		42688		42687		42686	
Location	7P		1SB		5P		4P		4D	
Percent Solids	94		89		95		95		96	
Analyte	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg
Aroclor 1016	U	44.3	U	46.8	U	43.9	U	43.9	U	43.4
Aroclor 1221	U	88.7	U	93.6	U	87.7	U	87.7	U	86.8
Aroclor 1232	U	44.3	U	46.8	U	43.9	U	43.9	U	43.4
Aroclor 1242	U	44.3	U	46.8	U	43.9	U	43.9	U	43.4
Aroclor 1248	U	44.3	U	46.8	U	43.9	U	43.9	U	43.4
Aroclor 1254	U	44.3	U	46.8	U	43.9	U	43.9	U	43.4
Aroclor 1260	26.6	44.3	U	46.8	U	43.9	U	43.9	U	43.4
Aroclor 1268	U	44.3	U	46.8	U	43.9	U	43.9	U	43.4

Table 1.1 (cont) Results of the Analysis for PCBs in Soil
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Dry Weight

Method REAC SOP 1801

Sample Number	42685		42679		42677		42676		42675	
Location	3D		2SB		2FB		1FB		2HP	
Percent Solids	98		87		94		94		90	
Analyte	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg
Aroclor 1016	U	42.5	U	47.9	U	44.3	U	44.3	U	46.3
Aroclor 1221	U	85.0	U	95.8	U	88.7	U	88.7	U	92.6
Aroclor 1232	U	42.5	U	47.9	U	44.3	U	44.3	U	46.3
Aroclor 1242	U	42.5	U	47.9	U	44.3	U	44.3	U	46.3
Aroclor 1248	U	42.5	U	47.9	U	44.3	U	44.3	U	46.3
Aroclor 1254	U	42.5	U	47.9	U	44.3	U	44.3	U	46.3
Aroclor 1260	U	42.5	U	47.9	U	44.3	U	44.3	U	46.3
Aroclor 1268	U	42.5	U	47.9	U	44.3	U	44.3	U	46.3

Table 1.1 (cont) Results of the Analysis for PCBs in Soil
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation

Method REAC SOP 1801

Page 3 of 3

Sample Number	SBLK111607	42660	1923*
Location	-	21-T	-
Percent Solids	100	100	100

Analyte	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg	Result. µg/kg	RL µg/kg
Aroclor 1016	U	41.7	23.1	J 41.7	26.4	J 41.7
Aroclor 1221	U	83.3	U	J 83.3	U	J 83.3
Aroclor 1232	U	41.7	U	J 41.7	U	J 41.7
Aroclor 1242	U	41.7	U	J 41.7	U	J 41.7
Aroclor 1248	U	41.7	U	J 41.7	U	J 41.7
Aroclor 1254	U	41.7	U	J 41.7	U	J 41.7
Aroclor 1260	U	41.7	22.4	J 41.7	59.0	J 41.7
Aroclor 1268	U	41.7	U	J 41.7	U	J 41.7

* Sample 1923 is a composite of samples 42680 and 42684.

Table 1.2 Results of the Analysis for Lead in Dust
 WA # 0-292 Ironbound Athletic Field Artificial Turf Investigation
 Results Are Based on Sample As Received

Method REAC SOP 1811

Page 1 of 1

Analyte		Lead	
Sample No.	Location	Result mg/kg	RL mg/kg
Method Blank-11/06/07	Lab	U	1.00
42657	17-T	1410	1.25
42658	19-T	1130	1.11
42659	16-T	2290	1.00
42660	21-T	230	1.00
42661	7-T	1340	1.00

Table 1.3 Results of the Analysis for Lead in Soil
 WA # 0-292 Ironbound Athletic Field Artificial Turf Investigation
 Results Are Based on Dry Weight

Method REAC SOP 1811

Page 1 of 1

Analyte			Lead	
Sample No.	Location	% Solids	Result mg/kg	RL mg/kg
Method Blank-11/05/07	Lab	NA	U	1.00
42669	2TB	95	4.18	0.966
42665	6P	96	22.3 J-	0.947
42673	2PM	91	5.38	0.999
42672	1PM	92	5.24	1.03
42671	1TB	94	8.22	0.976
42670	2TBD	94	4.10	0.967
42674	1HP	90	6.58	0.966
42668	2D	97	12.0 J-	0.982
42667	1D	98	14.0 J-	0.972
42666	7P	94	29.7 J-	0.994
42678	1SB	89	6.06	1.02
42688	5P	95	7.34 J-	0.957
42687	4P	95	9.80 J-	0.966
42686	4D	96	15.3 J-	0.974
42685	3D	98	8.87 J-	0.972
42679	2SB	87	10.5	1.03
42677	2FB	94	6.13	0.976
42676	1FB	94	13.0	0.967
42675	2HP	90	6.68	0.975

Table 1.4 Results of the Analysis for Lead in Mat and Residue
WA # 0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Sample As Received

Method REAC SOP 1811

Page 1 of 1

Analyte		Lead		
Sample No.	Location	Matrix Type	Result mg/kg	RL mg/kg
Method Blank 111207	Lab	NA	U	1.00
42699	7TB	Mat 1	3.55	3.45
42693	16TB	Mat 1	16.3	3.33
42693dup	16TB	Mat 1	14.8	3.33
42690	17TC	Mat 1	7.06	3.57
42682	19TB	Mat 1	5.97	3.03
42696	21TB	Mat 1	14.2	3.13
42700	7TC	Mat 2	25.1	3.33
42694	16TC	Mat 2	5.09	3.45
42691	17TD	Mat 2	U	3.13
42681	19TC	Mat 2	4.51	3.03
42697	21TC	Mat 2	4.76	3.23
42684	17TA	Residue	196 J+	2.00
42680	19TD	Residue	270 J+	1.64

Table 1.5 Results of the Analysis for Lead in Turf and Fibers
WA # 0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Sample As Received

Method REAC SOP 1811

Page 1 of 1

Analyte		Turf-Whole piece Lead		Turf (Fibers only) Lead	
Sample No.	Location	Result mg/kg	RL mg/kg	Result mg/kg	RL mg/kg
Method Blank	Lab	U	1.00	U	1.00
42683	19TA	3940	4.00	4850	5.56
42689	17TB	3990	3.33	4580	3.85
42692	16TA	4020	4.35	4950	5.56
42695	21TA	3960	4.55	4900	5.88
42698	7TA	3730	3.45	4920	5.26

Table 2.1 Results of the MS/MSD Analysis for PCBs in Soil
WA#0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Are Based on Dry Weight

Page 1 of 1

Sample ID: 42672

Analyte	Sample Conc µg/kg	MS/MSD		MS Conc µg/kg	MS % Recovery	MSD Conc µg/kg	MSD % Recovery	RPD
		Spike Added µg/kg	MS Conc µg/kg					
Aroclor 1016	U	181	138	76		131	72	5
Aroclor 1260	U	181	204	113		208	115	2

Sample ID: 42666

Analyte	Sample Conc µg/kg	MS/MSD		MS Conc µg/kg	MS % Recovery	MSD Conc µg/kg	MSD % Recovery	RPD
		Spike Added µg/kg	MS Conc µg/kg					
Aroclor 1016	U	177	180	102		222	125	21
Aroclor 1260	26.6	177	256	129		228	114	12

Table 2.2 Results of the MS/MSD Analysis for Lead in Dust
 WA#0-292 Ironbound Athletic Field Artificial Turf Investigation
 Results Are Based on Sample As Received

Page1 of 1

Sample No. 42660

Analyte	Sample Result mg/kg	MS/MSD Spike Added mg/kg	MS Result mg/kg	MS % Recovery	MSD Result mg/kg	MSD % Recovery	RPD	Recommended QC Limits % Recovery	RPD
Lead	230	40.0	285	NC	281	NC	NC	75-125	20

Table 2.3 Results of the MS/MSD Analysis for Lead in Soil
 WA#0-292 Ironbound Athletic Field Artificial Turf Investigation
 Results Are Based on Dry Weight

Page 1 of 1

Sample No. 42672

Analyte	Sample Result mg/kg	MS/MSD Spike Added mg/kg	MS Result mg/kg	MS % Recovery	MSD Result mg/kg	MSD % Recovery	RPD	Recommended QC Limits % Recovery	RPD
Lead	5.24	41.4	45.3	97	45.5	97	0	75-125	20

Sample No. 42666

Analyte	Sample Result mg/kg	MS/MSD Spike Added mg/kg	MS Result mg/kg	MS % Recovery	MSD Result mg/kg	MSD % Recovery	RPD	Recommended QC Limits %Rec	RPD
Lead	29.7	39.8	59.2	74 *	61.2	79	3	75-125	20

Table 2.4 Results of the MS/MSD Analysis for Lead in Mat
WA#0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Sample As Received

Page 1 of 1

Sample No. 42694

Analyte	Sample Result mg/kg	MS Spike Added mg/kg	MS Result mg/kg	MS % Recovery	MSD Spike Added mg/kg	MSD Result mg/kg	MSD % Recovery	RPD	Recommended QC Limits % Recovery	RPD
Lead	5.09	138	137	96	133	136	98	1	75-125	20

Table 2.5 Results of the MS/MSD Analysis for Lead in Residue
WA # 0-292 Ironbound Athletic Field Artificial Turf Investigation
Results Based on Sample As Received

Page 1 of 1

Sample No. 42684

Analyte	Sample Result mg/kg	MS/MSD Spike Added mg/kg	MS Result mg/kg	MS		MSD Result mg/kg	MSD		RPD	Recommended QC Limits	
				% Recovery			% Recovery			%Rec	RPD
Lead	196	80.0	312	145	*	306	138	*	2	75-125	20

Table 2.6 Results of the MS/MSD Analysis for Lead in Turf
 WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation
 Results Based on Sample As Received

Page 1 of 1

Sample No. 42695 (Turf whole piece)

Analyte	Sample Result mg/kg	MS Spike Added mg/kg	MS Result mg/kg	MS % Recovery	MSD Spike Added mg/kg	MSD Result mg/kg	MSD % Recovery	RPD	Recommended QC Limits	
									% Recovery	RPD
Lead	3960	160	4020	NC	148	3780	NC	6	75-125	20

Table 2.7 Results of the MS/MSD Analysis for Lead in Turf Fibers
 WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation
 Results Based on Sample As Received

Sample No. 42695(Fibers)

Page 1 of 1

Analyte	Sample Result mg/kg	MS/MSD Spike Added mg/kg	MS Result mg/kg	MS % Recovery	MSD Result mg/kg	MSD % Recovery	RPD	Recommended QC Limits	
								% Recovery	RPD
Lead	4900	200	5110	NC	5250	NC	3	75-125	20

Table 2.8 Results of the LCS Analysis for PCBs in Soil
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation

Page 1 of 1

LCS standard: SLCS-PS60
Date Analyzed: 11/6/07

Analyte	LCS Spike Added µg/kg	LCS Conc µg/kg	LCS % Recovery	Advisory QC Limits % Recovery
Aroclor 1016	167	159	95	70-130
Aroclor 1260	167	188	113	70-130

LCS standard: LCS/LCSD111608
Date Analyzed: 11/17/07

Analyte	LCS Spike Added µg/kg	LCS Conc µg/kg	LCS % Recovery	LCSD Conc µg/kg	LCSD % Recovery	RPD	RPD	Advisory QC Limits % Recovery
Aroclor 1016	167	129	77	137	82	6	20	70-130
Aroclor 1260	167	159	95	172	103	8	20	70-130

Table 2.9 Results of the LCS Analysis for Lead in Dust
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation

Page 1 of 1

LCS Standard: ERA Lot No. D056-540-11/06/07
Date Analyzed: 11/6/2007

Analyte	Conc. Recovered mg/kg	Certified Value mg/kg	PALs mg/kg	% Recovery
Lead	69.3	72.2	59.1 - 85.4	96

PAL - Performance Acceptance Limits

Table 2.10 Results of the LCS Analysis for Lead in Soil
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation

Page 1 of 1

LCS Standard: ERA Lot No. D056-540-11/05/07
Date Analyzed: 11/5/2007

Analyte	Conc. Recovered mg/kg	Certified Value mg/kg	PALs mg/kg	% Recovery
Lead	67.7	72.2	59.1 - 85.4	94

PAL - Performance Acceptance Limits

LCS Standard: ERA Lot No. D056-540-11/13/07
Date Analyzed: 11/13/2007

Analyte	Conc. Recovered mg/kg	Certified Value mg/kg	PALs mg/kg	% Recovery
Lead	64.1	72.2	59.1 - 85.4	89

PAL - Performance Acceptance Limits

Table 2.11 Results of the LCS/LCSD Analysis for Lead in Turf and Fibers
WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation

Page 1 of 1

LCS Standard: ERA Lot No. D056-540-111407

Date Analyzed: 11/15/2007

Analyte	Certified Value mg/kg	LCS Conc mg/kg	LCS % Recovery	LCSD Conc mg/kg	LCSD % Recovery	RPD	QC Limit RPD	PALs mg/kg
Lead	72.2	69.1	96	67.6	94	2	20	59.1-85.4

Table 2.12 Results of the Duplicate Analysis for Lead in Turf and Fibers
 WA# 0-292 Ironbound Athletic Field Artificial Turf Investigation
 Results Based on Sample As Received

Page 1 of 1

Sample 42689

Section	Initial Analysis mg/kg	Duplicate Analysis mg/kg	RPD	QC Limits RPD
Whole Turf piece	3990	3860	3	20
Fibers only	4580	4330	6	20

EP-C-04-032

0292-DAR-11260707

CHAIN OF CUSTODY RECORD

Site #: 292

Contact Name: D Killeen

Contact Phone: X4245

No: 292-11/02/07-0002

Lab #	Sample #	Location	Matrix	Collected	Numb Cont	Container	Preservative	Analyses	MS/MSD
15365	42669	2TB	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15366	42665	6P	Soil	11/1/2007	1	8 oz cwm	4 degrees C	PCBs	N
15367	42673	2PM	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15368	42672	1PM	Soil	11/1/2007	2	8 oz cwm	4 degrees C	PCBs	Y
↓	42672	1PM	Soil	11/1/2007	2	8 oz cwm	4 degrees C	Lead (Pb)	Y
15369	42671	1TB	Soil	11/1/2007	1	8 oz cwm	4 degrees C	PCBs	N
↓	42671	1TB	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15370	42670	2TBD	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15371	42674	1HP	Soil	11/1/2007	1	8 oz cwm	4 degrees C	PCBs	N
15365	42669	2TB	Soil	11/1/2007	1	8 oz cwm	4 degrees C	PCBs	N
15371	42674	1HP	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15372	42668	2D	Soil	11/1/2007	1	8 oz cwm	4 degrees C	PCBs	N
↓	42668	2D	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15373	42667	1D	Soil	11/1/2007	1	8 oz cwm	4 degrees C	PCBs	N
↓	42667	1D	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15374	42666	7P	Soil	11/1/2007	2	8 oz cwm	4 degrees C	PCBs	Y
↓	42666	7P	Soil	11/1/2007	2	8 oz cwm	4 degrees C	Lead (Pb)	Y
15366	42665	6P	Soil	11/1/2007	1	8 oz cwm	4 degrees C	Lead (Pb)	N
15370	42670	2TBD	Soil	11/1/2007	1	8 oz cwm	4 degrees C	PCBs	N

Special Instructions: Pb prelims due in 2-3 days, PCB prelims in 5 days

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time
all analysis	J. Killeen	11/5/07	J. Killeen	11/5/07	8:00	Metals	J. Killeen	11/5/07	J. Killeen	11/5/07	8:45 AM
10/Analysis	J. Killeen	11/5/07	J. Killeen	11/5/07	10:10	PCB	J. Killeen	11/5/07	J. Killeen	11/5/07	11:30 AM
10/Analysis	J. Killeen	11/5/07	J. Killeen	11/5/07		All Analysis	J. Killeen	11/5/07	J. Killeen	11/5/07	

0292-DAR-11260707
EP-C-04-032

CHAIN OF CUSTODY RECORD

Site #: 292

Contact Name: Deborah Killeen

Contact Phone: 732-321-4245

No: 292-11/02/07-0003

Lab: REAC

Lab Phone: 732-321-4252

Lab #	Sample #	Location	Matrix	Collected	Numb Cont	Container	Preservative	Analyses	MS/MSD
15419	42680	19TD	Residue	11/1/2007	1	8 oz cwm	None	Lead (Pb)	N
15420	42681	19TC	Mat 2	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15421	42682	19TB	Mat 1	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15422	42683	19TA	Turf	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15423	42684	17TA	Residue	11/1/2007	1	8 oz cwm	None	Lead (Pb)	N
15424	42689	17TB	Turf	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15425	42690	17TC	Mat 1	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15426	42691	17TD	Mat 2	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15427	42692	16TA	Turf	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15428	42693	16TB	Mat 1	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15429	42694	16TC	Mat 2	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15430	42695	21TA	Turf	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15431	42696	21TB	Mat 1	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15432	42697	21TC	Mat 2	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15433	42698	7TA	Turf	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15434	42699	7TB	Mat 1	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N
15435	42700	7TC	Mat 2	11/1/2007	1	Ziploc Bag	None	Lead (Pb)	N

Special Instructions: Prep samples as discussed during teleconference with ERT WAM.

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time
All Analysis	Deborah Killeen	11/6/07	Tracy Martin	11/6/07	8:10	All Analysis	Tracy Martin	11/8/07	NAR Shett	11/8/07	8:00
All Storages	NAR Shett	11/15/07	Tracy Martin	11/15/07	9:30						

Deborah Killeen (Task leader) 732-321-4245

Sheet 01 of 01 (Do not copy)
(for addnl. samples use new form)

Analyses Requested

REACH	Sample No	Sampling Location	Matrix	Date Collected	# of Bottles	Container/Preservative	PCBs
5417	42660	21-T	S	11/11/07	1	8oz Jar / None	✓
5467	1923 *	N/A	↓	↓	↓	↓	✓
21 11/11/07							
21 11/11/07							

Special Instructions:

PW- Potable Water
S- Soil
SD- Sediment
SL- Sludge
SW- Surface Water
TX-TCLP Extract
W- Water
X- Other

* Sample is a composite of samples 15419 and 15423 on Coc# 292-110207-0003. 15g of each sample was homogenized to make a 30g composite sample.

**** Reac #'s are not chronological**

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #:

15417 → COC# 292-110607-0004
COC# 292-110607-0003

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished by	Date	Received by	Date	Time
All Analysis's	Johnny Martin	11/14/02	[Signature]	11/14/02	16:00						

APPENDIX B
Sample Photographs
Ironbound Athletic Field Artificial Turf Investigation
Newark, New Jersey
December 2007



Figure 2. Turf sample 16T(top)

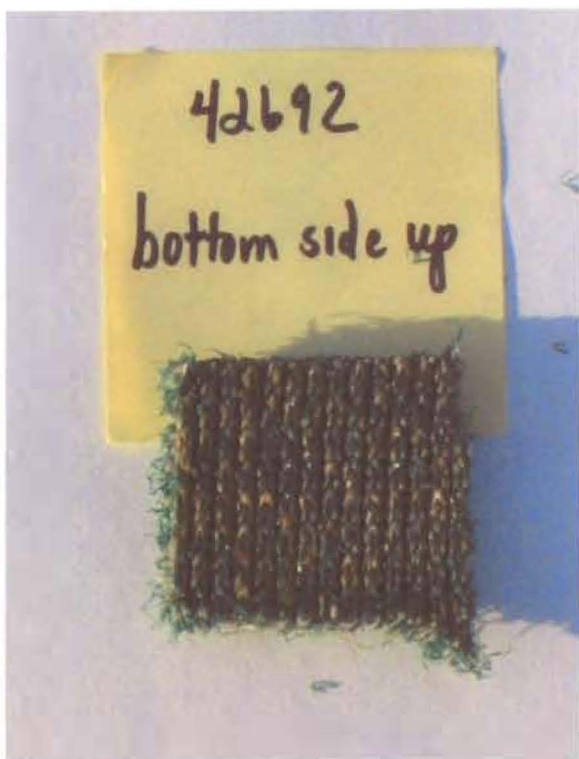


Figure 3. Turf sample 16T (bottom)

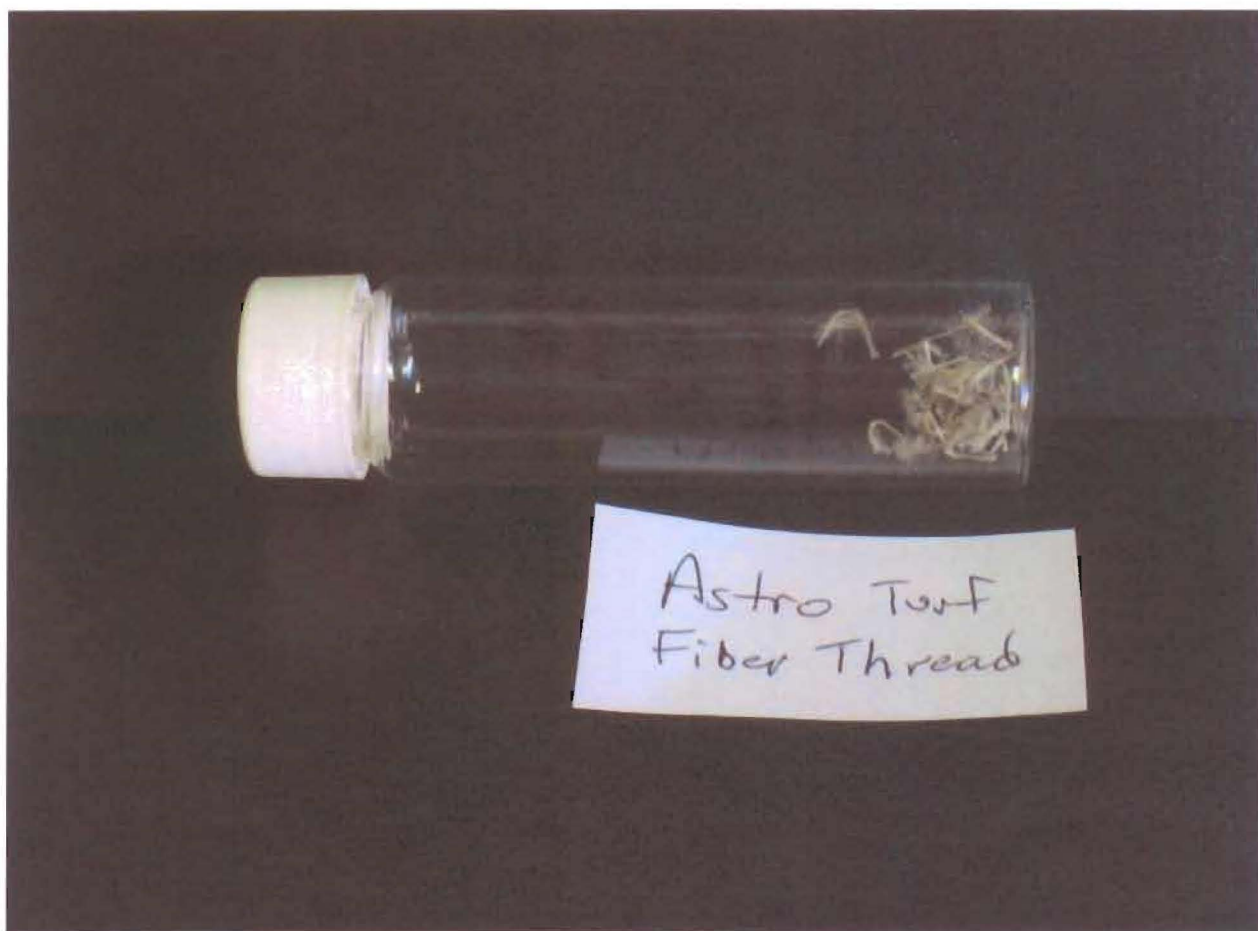


Figure 4. Artificial turf fibers



Figure 5. Dust sample 7T (coarse)

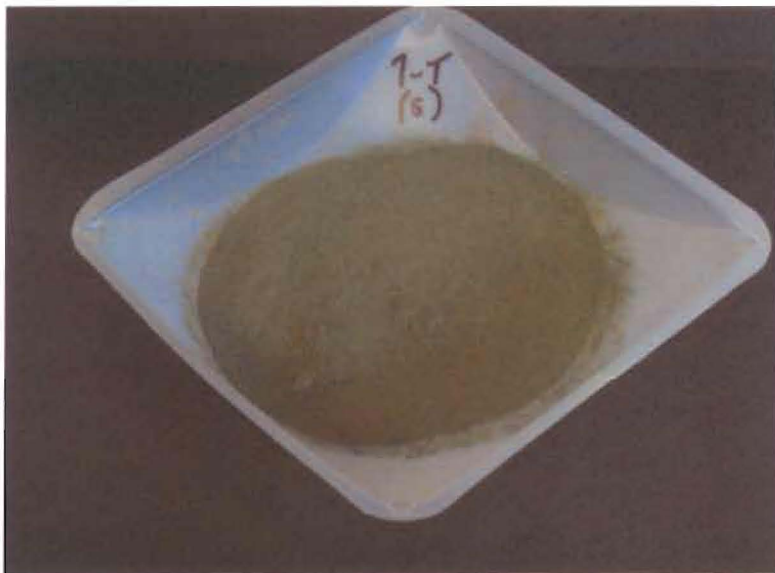


Figure 6. Dust sample 7T (sieved)



Figure 7. Dust sample 16T (coarse)



Figure 8. Dust sample 16T (seived)



Figure 9. Dust sample 17T (coarse)

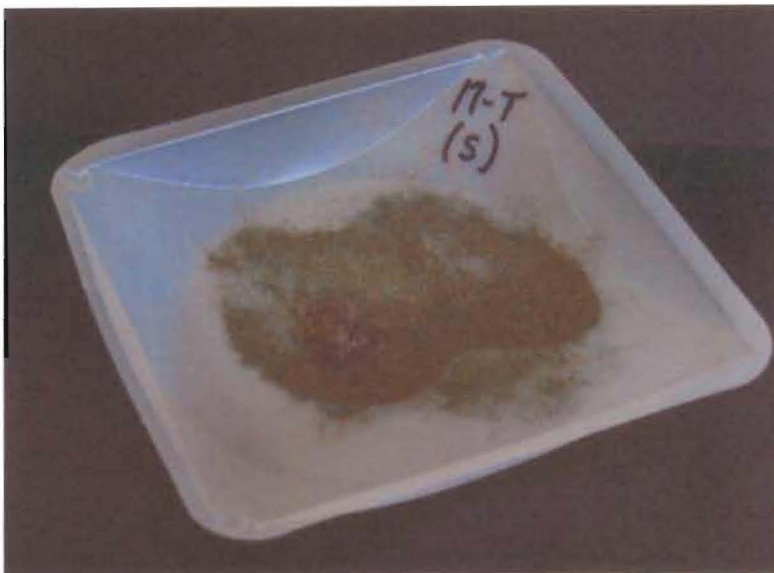


Figure 10. Dust sample 17T (sieved)



Figure 11. Dust sample 19T (coarse)

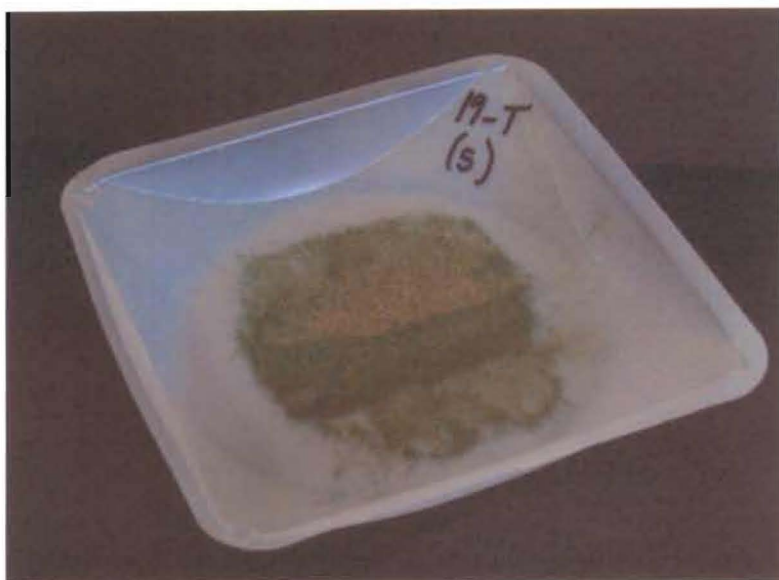


Figure 12. Dust sample 19T (sieved)

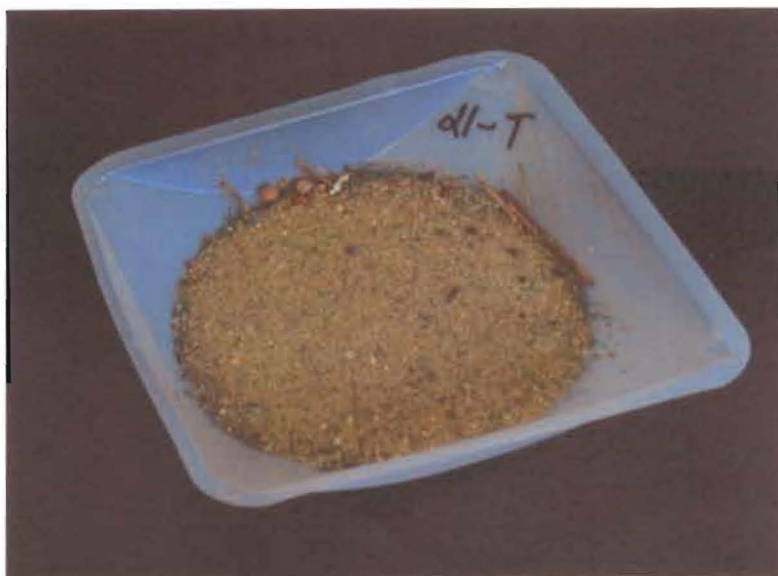


Figure 13. Dust sample 21T (coarse)

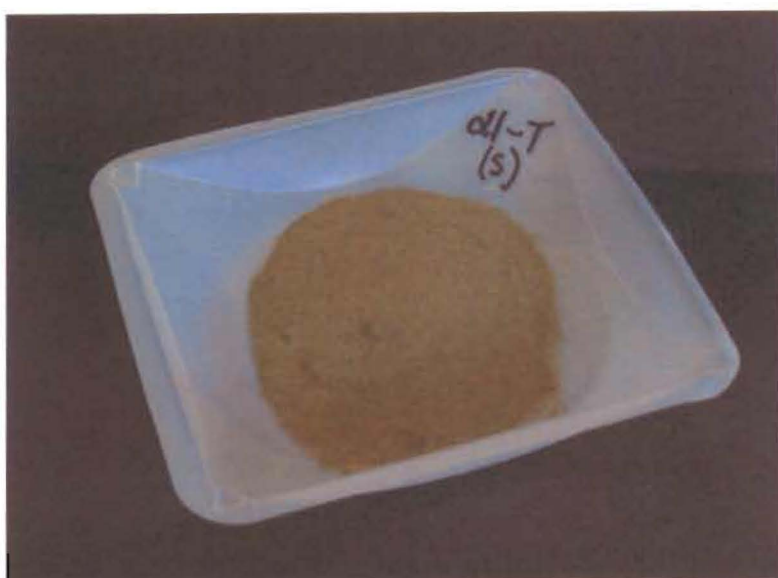


Figure 14. Dust sample 21T (sieved)



Figure 15. Turf and substrate